

Australian Standard™

Calibration and classification of force-measuring systems

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Australian Standard™

Calibration and classification of force-measuring systems

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PREFACE

This Standard was prepared by the Standards Australia Committee MT-006, Mechanical Testing of Metals, to supersede AS 2193—1978, *Methods for calibration and grading of force-measuring systems of testing machines*.

The objective of this revision is to upgrade the requirements and procedures for the calibration and classification of force-measuring systems and working force standards.

A significant change to the Standard is the modification of the name from *Methods for calibration and grading of force-measuring systems of testing machines* to *Calibration and classification of force-measuring systems*. The methods set out in Section three of the superseded Standard have been used to calibrate and grade force-measuring systems or instruments (e.g. soil testing rings) which are not testing machines by definition. The name change reflects the application of this Standard to force measurement, generally, while still specifying appropriate procedures that apply to force-measuring systems whether or not they are an integral part of a testing machine.

Other significant changes have been made to align with recent International Standards, ISO 376:1999, and ISO 7500-1:1999. The most obvious change is the use of Class instead of Grade. There were two reasons for this. To adopt the internationally accepted terms Class and Classification and to discriminate between Grades/Classes allocated in accordance with the old and the new Standard. In Section 3 the addition of Class AA for force-measuring systems is included. Section 4 now includes a Class 0 and a Class 3 for working force standards. However, there are some procedural differences between the ISO Standard, and AS 2193. AS 2193 provides more guidance to the calibration procedures, particularly to the calculation of the uncertainties in accordance with the ISO GUM. The uncertainty evaluation of calibration results is necessary to fulfil the technical requirement for laboratory accreditation in Australia. In addition, the classification of testing machines in ISO 7500-1 does not cover 5% accuracy testing machines currently in use in Australia.

During the preparation of this edition, cognizance was taken of the following Standards:

ISO

- 376 Metallic materials—Calibration of force-proving instruments used for the verification of uniaxial testing machines
- 7500 Metallic materials—Verification of static uniaxial testing machines
- 7500-1 Part 1: Tension/compression testing machines—Verification and calibration of the force-measuring system

ASTM

- E 74 Standard practice of calibration of working force standards for verifying the load indication of testing machines

AS ISO/IEC

- 17025 General requirements for the competence of testing and calibration laboratories

ISO

- GUM Guide to the Expression of Uncertainty in Measurement

The term 'informative' has been used in this Standard to define the application of the appendix to which it applies. An 'informative' appendix is only for information and guidance.

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FOREWORD

Calibration of working force standards is performed in either primary or secondary force standardizing machines by applying forces of known magnitude and uncertainty and deriving a mathematical relationship between applied force and instrument readings. The estimation of the uncertainty associated with this mathematical relationship is included in the procedure.

Calibration of force-measuring systems comprises a comparison between indicated and applied forces of known magnitude and uncertainty by means of suitable working force standards.

Calibration includes an assessment of readability, repeatability and accuracy of the indicated force, the assignment of class or classes and the issue of a report.

Force-measuring systems referred to in this Standard are those associated with force-testing machines or any other machinery or instruments where force application is measured. In the case of testing machines, they may be classified as tension or compression machines depending on the mode of straining applied to the test piece. Some machines have provision for more than one mode of straining.

It is necessary for machines and force-measuring systems to be maintained in good working order and condition. Regular servicing is recommended, the frequency of the servicing being dependent on the frequency and conditions of use. All force-measuring systems should be calibrated periodically so that their results are reliable and consistent with those obtained from other force-measuring systems. However, the test data obtained depend also on the testing techniques used. It is important for users of this Standard to make reference to the specified method of test and also to printed literature provided by manufacturers of testing equipment.

Calibration authorities and force-measuring system users should note that the calibration procedures specified in this Standard apply only to statically applied forces.

Special procedures, which are outside the scope of this Standard, should be followed for dynamic calibration of force-measuring systems employing high rates of force application.

STANDARDS AUSTRALIA

Australian Standard**Calibration and classification of force-measuring systems**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for the static calibration of force-measuring instruments and their classification as working force standards. It also specifies the requirements for the static calibration of force-measuring systems of uniaxial testing machines and other force-measuring systems used for measuring the strength and other properties of materials, components, products and assemblies.

The Standard covers the following subjects:

- (a) Classification requirements for force-measuring systems of testing machines and other force-measuring systems.
- (b) Procedures for the calibration of force-measuring systems.
- (c) Requirements for the calibration and the classification of working force standards used for the verification of force-measuring systems.

NOTES:

- 1 Requirements for extensometers used in conjunction with tension and compression testing machines are given in AS 1545.
- 2 Advice and recommendations on information necessary for the performance of calibration are contained in the purchasing guidelines set out in Appendix A.

This Standard applies to testing machines and force-measuring systems which indicate in terms of the SI unit of force, the newton (N), or in arbitrary units.

NOTE: Reference should be made to AS/NZS 1376 for the relationship between the newton and technical units of force.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1545	Methods for the calibration and grading of extensometers
2103	Dial gauges and dial test indicators (metric series)
2706	Numerical values—Rounding and interpretation of limiting values
2807	Vocabulary of basic and general terms in metrology
AS ISO/IEC	
17025	General requirements for the competence of testing and calibration laboratories.
AS/NZS	
1376	Conversion factors